M54 to M6 Link Road

TR010054

Volume 6

6.3 Environmental Statement Appendices

Appendix 14.1 Climate Resilience Baseline

Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

January 2020

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

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Development Consent Order 202[ ]

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Appendix 14.1 Climate Resilience Baseline

Regulation Number	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010054
Application Document Reference	6.3
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1	January 2020	DCO Application

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1 Climate resilience baseline

1.1 Current baseline

1.1.1 Staffordshire's Local Transport Plan (Ref 1) outlines the likelihood of severe weather events such as flooding, storm damage, droughts and heatwaves becoming more frequent in the future and outlines a number of secondary consequences relating to road networks. These include increased incidence of ground stability and movement, and periods of poor air quality in the summer.

1.1.2 The current baseline for the climate change resilience review is the current climate in the location of the Scheme. Met Office historic climate data (Ref 2) has been obtained from the Penkridge Climate Station (the closest climate station to the Scheme boundary), showing that for the period 1981 - 2010:

a) Average annual maximum daily temperature was 13.7 °C.
b) July was the warmest month on average (mean maximum daily temperature of 21.5 °C).
c) February was the coldest month on average (mean daily minimum temperature of 1.2 °C).
d) Mean annual rainfall levels were 681.2 mm.
e) October was the wettest month on average (67.4 mm of rainfall on average for the month).
f) February was the driest month on average (39.7 mm of rainfall on average for the month).

1.1.3 The Met Office historic 10-year averages for the Midlands region (Ref 3) identify gradual warming (although not uniformly so) between 1969 and 2018, also with increased rainfall. Information on mean maximum annual temperatures (°C) and mean annual rainfall (mm) is summarised in Table 1.1.

Table 1.1: Historic 10-year averages for temperature and rainfall for the Midlands region

Climate Period	Climate Variables	
	Mean maximum annual temperatures (°C)	Mean annual rainfall (mm)
1969-1978	12.817	728.04
1979-1988	12.606	797.32
1989-1998	13.512	744.48
1999-2008	13.970	843.01
2009-2018	13.846	783.20

1.1.4 As noted by the UK Climate Change Risk Assessment (CCRA) (Ref 4), the UK's transport infrastructure is already being affected by severe weather events.

1.1.5 Specifically for transport infrastructure, the CCRA identifies two key risks:

a) Changes in extreme weather conditions, which will affect infrastructure, in particular through storm damage, flooding and high temperatures.

b) Flooding of transport, including roads and rail is likely to increase, affecting both urban and rural access routes.

1.2 Future baseline – Climate resilience assessment

1.2.1 The future baseline is expected to differ from the present-day baseline. UK Climate Projections 2018 (UKCP18) have been developed by the UK Climate Impacts Programme (UKCIP) (Ref 5) to provide projections for future climate scenarios and trends. The UKCP18 data is the most robust source of information on the UK's future climate.

1.2.2 UKCP18 provides probabilistic projections for pre-defined 20-year time periods (for example 2020-2039, 2040-2059, 2060-2079, and 2080-2099). For the purpose of the Scheme, UKCP18 projections for the following climate variables have been obtained and analysed:

- mean annual temperature;
- mean summer temperature;
- mean winter temperature;
- maximum summer temperature;
- minimum winter temperature;
- mean annual precipitation;
- mean summer precipitation; and
- mean winter precipitation.

1.2.3 A range of possible Representative Concentration Pathways (RCPs), selected from the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (Ref 6), have been used by UKCP18 to inform differing future emission trends. The four scenarios are RCP2.6, RCP4.5, RCP6.0 and RCP8.5. RCP8.5 is the closest to the UKCP09 high emissions scenario previously used as best-practice for climate assessment.

Table 1.2: RCP Description

RCP	Description
RCP2.6	Represents a pathway where GHG emissions are strongly reduced, resulting in a best estimate global average temperature rise of 1.6°C by 2100 compared to the pre-industrial period.
RCP4.5	Medium stabilisation pathway, with some level of mitigation, resulting in a best estimate global average temperature rise of 2.4°C by 2100 compared to the pre-industrial period.
RCP6.0	Medium stabilisation pathway, with some level of mitigation, resulting in a best estimate global average temperature rise of 2.8°C by 2100 compared to the pre-industrial period.
RCP8.5	A pathway where GHG emissions continue to grow unmitigated, leading to a best estimate global average temperature rise of 4.3°C by 2100 compared to the pre-industrial period.

1.2.4 IPCC provides evidence to suggest that current global population and urbanisation trends, slow uptake of renewable energy sources, delay in nuclear power growth, and slow development of international climate change policy means that it is most likely that global emissions will follow the predicted RCP8.5 pathway.

1.2.5 UKCP18 allows for future climate projections across a range of probability levels to be assessed, ranging from 10% probability to 90% probability:

- 10% probability level – this demonstrates what the future change is unlikely to be less than. There is a 90% chance the projected change will be more than this.
- 50% probability level – this is known as the central estimate, with an even chance of it occurring and not occurring.
- 90% probability level – this demonstrates what the future change is unlikely to be more than. There is a 10% chance the projected change will be more than this.

1.2.6 Projected temperature and precipitation variables are presented in Table 1.3 and Table 1.4 respectively. UKCP18 probabilistic projections for RCP8.5 have been analysed for the 25 km^2 grid square where the Scheme is located. These figures are expressed as temperature and precipitation anomalies in relation to the 1981-2000 baseline. The 50% probability level has been presented, as well as the range (10% to 90% probability levels).

Table 1.3: Projected changes to temperature variables (°C)

Climate Variable		Time period			
		2020-2039	2040-2059	2060-2079	2080-2099
Mean annual air temperature anomaly at 1.5m (°C)	50% probability	+0.9	+1.7	+2.7	+4
	Range	+0.3 to +1.6	+0.7 to +2.7	+1.1 to +4.3	+2.0 to +6.1
Mean summer air temperature anomaly at 1.5m (°C)	50% probability	+1.1	+2.1	+3.3	+5.2
	Range	+0.2 to +2.0	+0.7 to +3.7	+0.9 to +5.9	+2.1 to +8.6
Mean winter air temperature anomaly at 1.5m (°C)	50% probability	+0.9	+1.6	+2.4	+3.4
	Range	0.0 to +1.9	+0.4 to +2.9	+0.7 to +4.1	+1.3 to +5.6
Maximum summer air temperature anomaly at 1.5m (°C)	50% probability	+1.4	+2.6	+3.9	+5.9
	Range	+0.3 to +2.6	+0.8 to +4.5	+1.1 to +6.9	+2.2 to +9.9
Minimum winter air temperature anomaly at 1.5m (°C)	50% probability	+0.8	+1.6	+2.4	+3.4
	Range	-0.1 to +1.8	+0.3 to 3.0	+0.7 to +4.3	+1.1 to +6.0

Table 1.4: Projected changes to precipitation variables (%)

Climate Variable		Time period			
		2020-2039	2040-2059	2060-2079	2080-2099
Annual precipitation rate anomaly (%)	50% probability	+1	-1	0	0
	Range	-3 to +6	-7 to +5	-5 to +5	+6 to +6
Summer precipitation rate anomaly (%)	50% probability	-9	-19	-29	-37
	Range	-28 to +12	-38 to 0	-56 to -2	-66 to -6
Winter precipitation rate anomaly (%)	50% probability	+5	+8	+16	+20

1.2.7 These UKCP18 projections represent average weather conditions and do not capture the full range of possible future severe weather events (i.e. droughts, heatwaves and prolonged heavy rainfall).

1.2.8 UKCP18 climate change projections have been used qualitatively to identify how events associated with climatic variables change over time. Baseline climatic conditions (as identified through Met Office datasets) can subsequently be compared against climate change projections to indicate the direction and degree of change. This approach allows these events to be prioritised over the duration of a proposed scheme and the requirement for mitigation and adaptation responses to be identified and programmed accordingly.

2 References

Ref 1 Staffordshire County Council (2011) Staffordshire Local Transport Plan 2011

Ref 2 Met Office (2010) The Met Office historic climate data. Available from: www.metoffice.gov.uk/public/weather/climate/gcqfp5e8q

Ref 3 Met Office (2019) The Met Office UK and Regional Series. Available from: https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-and-regional-series

Ref 4 Committee for Climate Change (2017) UK Climate Change Risk Assessment.

Ref 5 UK Met Office (2018) UK Climate Projections 2018 (UKCP18). Available from: https://www.metoffice.gov.uk/research/collaboration/ukcp/download-data

Ref 6 Intergovernmental Panel on Climate Change (IPCC) (2014) Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change